CERTIFICATE OF MAILING

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Date: October ~~8~~ 9, 2001 RG

IN THE UNITED STATES

PATENT AND TRADEMARK OFFICE

Confirmation #	2221	)
Applicant:	MUKHOPADHYAY, Debasish	)
Serial No.:	09/243,237	)
Filed:	02/02/99	)
Title:	HIGH PURITY WATER PRODUCED BY REVERSE OSMOSIS	)
Art Unit:	1723	)
Examiner:	Fortuna, A.	)

Assistant Commissioner for Patents
Washington, D.C. 20231

TRANSMITTAL OF INFORMATION DISCLOSURE STATEMENT WITHIN THREE MONTHS OF FILING OR BEFORE MAILING OF FIRST OFFICE ACTION (37 C.F.R. § 1.97(b))

Sir:

The information disclosure statement submitted herewith is being filed with a Continued Prosecution Application for this matter. Consequently, it is considered filed before the mailing date of the first Office action on the merits in the present application.

Respectfully submitted,

R. Reams Goodloe
SIGNATURE OF ATTORNEY

Date: October 6, 2001

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IN THE UNITED STATES

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Applicant:	MUKHOPADHYAY, Debasish
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Art Unit:	1723
Examiner:	Fortuna, A.

INFORMATION DISCLOSURE STATEMENT

Assistant Commissioner for Patents
Washington, D.C. 20231

Sir:

The following sections are being submitted for this Information Disclosure Statement:

1. Preliminary Statements
2. Identification Of Time of Filing
3. Statements With Respect to Listing of Information
4. Identification of Prior Application in Which Listed Information Was Already Cited and For Which No Copies Are Submitted or Need to be Submitted.
5. Statements With Respect To Copies Of Listed Information Items Accompanying This Statement
6. Concise Explanation of Listed Information Items
7. Translation of Non-English Language Documents
8. Identification of Person Making This INFORMATION DISCLOSURE STATEMENT.

A return receipt postcard is also enclosed.

CERTIFICATE OF MAILING

I hereby certify that this Information Disclosure Statement (along with any paper referred to as being attached or enclosed) is being deposited with the United States Postal Service on the date shown below with sufficient postage as Express Mail Post Office to Addressee, mailing label No.: ET525570418US in an envelope addressed to:
Assistant Commissioner For Patents, Washington, D.C. 20231.

Rhonda Goodloe
Rhonda Goodloe

Date: October ~~8~~ 9, 2001 RG

1. Preliminary Statements

Applicant submits herewith a listing of patents and other art of which he is aware which he believes may possibly be material to the examination of this application and in respect of which there may be a duty to disclose in accordance with 37 CFR § 1.56.

The filing of this information disclosure statement shall not be construed as an admission that the information cited is, or is considered to be, material to patentability, or an assertion that no other material information exists.

The filing of this information disclosure statement shall not be construed as an admission against interest in any manner. Notice of January 9, 1992, 1135 O.G. 13-25, at 25.

In particular, it is noted that certain of the documents disclosed herein, based on date of publication, may not be prior art to the applicant; however, such publications are offered for consideration with respect to the state of development of the art.

2. Time of Filing

This Information Disclosure Statement is filed with a Continued Prosecution Application for this matter. Consequently, it is considered filed before the mailing date of the first Office Action on the merits in the present application.

3. Statements With Respect To Listing of Information

A list of the patent(s) and/or publication(s) is set forth on the attached page of Form PTO-1449 (Modified).

4. Identification of Prior Application in Which listed Information Was Already Cited and for Which No Copies are Submitted or Need to be Submitted.

This application relies, under 35 U.S.C. §121, on the earlier filing date of prior application Serial No. 08/909,861 filed August 12, 1997.

The references which were submitted to, and/or cited by, the Office in the prior application(s) and made of reference in Patent No. 5,925,255, are not required to be provided in this application. However, if for any reason the examiner disagrees, or if the examiner is unable to locate such files at the Patent Office, the undersigned will promptly provide fresh copies of any or all of the identifed references if called upon by the examiner to do so.

5. Statements With Respect To Copies of Listed Information Items Accompanying This Statement

Legible copies of items listed in Forms PTO 1449 accompany this information statement except for items which have already been disclosed in this or in the prior related applications; such items not submitted are marked by an "*" asterik.

6. Concise Explanation of Listed Information Items

A concise explanation of the items listed on PTO-1449 (Modified) is given for each listed item.

Patent No.	Inventor/ Issued	Explanation
*3,721,621	Hough 03/20/73	Uses pH adjustment to adjust solubility of a solute in water prior to membrane separation. Generally, see col. 3 and col. 4, and claim 1.
*3,870,033	Faylor, et al 03/11/75	Describes process for producing 18 meg-ohm water for semi-conductor manufacturing. See Fig. 1 and col. 5, line 67 to col. 6, line 8, where flow path 32a is described to incorporate a softener before an RO unit, and a degasifier after the RO unit.

*3,953,580	Allen, et al 04/27/76	States that in RO systems, an increase in boron rejection occurs with an increase in pH. See col. 1, lines 43-51. Allen concludes that borate ion is rejected by the RO membrane, so he teaches that boric acid production is assisted by utilizing membranes having low boron rejection, and operating a suitable pH, so that the desired boron is preferentially transported with the clean permeate, rather than rejected (as desired in water purification).
*3,964,999	Chisdes 06/22/76	Discloses hardness removal before an RO system. See Fig. 1.
*3,985,648	Casolo 10/12/76	Discloses multi-bed ion exchange system, including a weak acid cation exchange resin in the hydrogen form, for purifying mineral contaminated water. See Fig. 1 and claim 1.
*4,182,676	Casolo 01/08/80	Discloses multi-bed ion exchange system, including weak acid cation exchange resin in hydrogen form, to capture selected contaminants at optimum pH ranges. See col. 4, lines 12-27 and claim 1.
*4,235,715	Wiegert 11/25/80	Discloses removal of hardness and alkalinity in boiler feedwater by (a) use of weak acid cation resin in the hydrogen form, (b) degasification, and (c) followed by weak acid cation resin in the sodium form. See Fig. 2 and col. 2, line 15 through col. 3, line 3.

*4,321,145	Carlson 03/23/82	Discloses use of ion exchange to remove cyanide values from water, and recovery of cyanide salt liquor by treating the ion-exchange rinse streams with caustic solution. See col. 1, lines 54-59.
*4,430,226	Hegde, et al 02/07/84	Discloses production of 18 meg-ohm water by pretreating a feed stream in an admixture of mixed-ion exchange resin and activated carbon, before RO treatment. See col. 2, lines 1-16.
*4,532,045	Littman 07/30/85	In a cooling tower circulating water system, teaches removal of hardness and bicarbonate values with a weak acid cation exchange system, removal of suspended solids, and adding scale inhibitors, to minimize blow-down rates from the circulating system. See col. 4, lines 30-68.
*4,532,047	Dubin 07/30/85	Generally describes various efforts to control silica scale in conventional water treatment systems, and additives useful for controlling such scale. Table I describes amorphous silica solubility vs. pH.
*4,548,716	Boeve 10/22/85	Describes production of bacteria and pyrogen free, ultra-pure water, by deionizing the water (using RO, ion-exchange) and purifying the water (UV, and ozone). See col. 3, lines 3-26, and claim 12.

*4,574,049	Pittner 03/04/86	Describes injection of a solution having a pH in excess of 7 to the "second stage" of a reverse osmosis system (more conventionally, "second pass" since the second unit treats permeate from the first unit) to ionize certain otherwise difficult to ionize components to increase their rejection in the RO system. See col. 4, lines 5-48. Pittner removes hardness by an ion-exchange resin type softener, but does not include degasification or alkalinity removal prior to starting RO processing of the feedwater.
*4,698,153	Matsuzaki, et al 10/06/87	Shows production of ultrapure water via RO and ion-exchange. Feed to an RO unit is filtered, and permeate is degassed and sent to ion-exchange. See Fig. 3 and claim 8.
*4,755,298	Grinstead 07/05/88	Describes removal of boron ion from aqueous brines via use of a water soluble organic chelant, preferably at pH between about 5 and 9, and then releasing the boron by contacting the chelant with a mineral acid, then recovering the chelant. See col. 11, line 34 through col. 2, line 11.
*4,820,421	Auerswald 04/11/89	Describes process of demineralizing power plant feedwater by using a series of at least three ion exchange resin treatment zones, including strong acid cation (SAC), anion resin, and weak acid cation (WAC) treatment. For general information, see col. 5, line 50 through col. 6, line 44.

*4,824,574	Cadotte, et al 04/25/89	Describes flux rates, problems of membrane plugging, and rejection enhancement, in RO systems, where the membrane is used for hardness removal. See col. 1., lines 40-50 regarding membrane flux ("..flux of at least 10, preferably at least about 15 gallons per square foot per day... would be desirable."). Also, see claim 2 regarding a membrane with a flux of "at least 15 gpd".
*4,900,450	Schmidt 02/13/90	Describes the use of a weak acid cation (WAC) resin bed to remove residual alkalinity from water after it passes through a strong acid cation resin bed. See col. 2, lines 10-24, regarding use of WAC at near neutral pH conditions.
*4,917,806	Matsunaga, et al 04/17/90	Describes the adjustment of pH of water, by control of water flow rate through a pair of ion exchange beds, to control the pH of the mixed outlet stream from the ion exchange units. See col. 2, line 40 through col. 3, line 4.
*4,969,520	Jan, et al 11/13/90	Describes co-precipitation of silica with magnesium hydroxide after mixing caustic with feedwater containing calcium and magnesium, and removal of residual hardness by WAC type ion-exchange resins. See (a) FIG. 1, (b) col. 1, line 53 through col. 2, line 3, and (c) col. 6, lines 38-56.
*4,995,983	Eadie, et al 02/26/91	Describes recovery of peroxide from alkaline wastewater of pulp bleaching process in a reverse osmosis system. The fraction of peroxide in ionized form, and thus the recovery of peroxide, is increased by adjustment of pH to at least 11.5. See col. 4, lines 27-58.

*5,028,336	Bartels, et al 07/02/91	Describes processing of oil production "produced waste waters" by nanofiltration at increased pH's, preferably 7-9, "say about 8.5," to remove water soluble organic electrolytes. See col. 11, line 20 through col. 12, line 2, and col. 15, lines 32-40.
*5,061,374	Lewis 10/29/91	Describes a two train ultrapure water production system for manufacture of 18 meg-ohm water, via treatment through a mixed bed ion exchange unit, a UV sterillizer, an RO unit, and a filter. See col. 2, lines 23-44, and claim 1.
*5,073,268	Saito, et al 12/17/91	Discloses process for manufacture of ultrapure (18 meg-ohm) water. The process includes the use of a UV/hydrogen irradiation unit followed by a mixed bed ion exchange polisher, before entry into a RO unit. See Table 2 for actual results achieved by the process; Table 1 indicates industry quality standards. Use of mixed bed type ion exchange resins with H+ type strongly acidic cation exchange resin, and OH-type strongly basic anion exchange resin, results in no pH change to the feedwater stream after treatment, since the eluted ions combine to form water. See col. 6, lines 10-21.
*5,174,901	Smith 12/29/92	Shows use of sand filter, carbon filter, and water softener prior to an RO unit. See Fig. 1.
*5,236,722	Schroeder 08/17/93	Describes process of removing hardness t less than 2 grains prior to reverse osmosis, and removing organic and inorganic matter in an RO unit. See col. 1, line 66 through col. 2, line 9.

*5,246,586	Ban, et al 09/21/93	Describes a "2B3T" (two bed, three tower) type system for pre-treatment of a feedwater to a reverse osmosis unit engaged in production of ultrapure water. A cation exchange resin tower, a decarbonation tower, and an anion exchange resin tower are serially connected for treatment of feedwater. The pH is adjusted by introducing acid or alkali prior to feed to the cation exchange resin tower, or elsewhere. See (a) col. 5, line 57 through col. 6, line 2, (b) Fig. 3, and (c) claim 1.

*5,250,185	Tao, et al 10/05/93	Describes processing of oilfield produced waters containing boron and water soluble organic electrolytes. Hardness removal is followed by raising the pH to above about 9.5, before processing the charge liquid in a reverse osmosis unit. See col. 4, line 46, through col. 6, line 4. Although it is inherent in Tao's process that alkalinity associated with temporary hardness is removed (calcium bicarbonate and magnesium bicarbonate), the process does not remove the alkalinity not associated with hardness (mainly, sodium bicarbonate). As a result the Tao process does not need or use a degasifier, and is also forced to use anti-scalant, to prevent precipitation of calcium carbonate. Tao's process fails to remove the bulk of the alkalinity before charge of feedwater to the reverse osmosis unit, as taught by the claimed invention herein. Also, Tao's process uses lime softening primarily to <u>remove</u> silica (see col. 7, lines 17-28), to keep the reverse osmosis unit from fouling with silica. In contrast, the present invention does not require a silica removal pretreatment step, as the pH is raised to insure high silica solubility. Additionally, Tao recommends the use of anti-scalant, whereas the present invention avoids the necessity to use scale inhibitor. See Tao, col. 4, line 57 through col. 5, line 2.

*5,266,203	Mukhopadhyay, et al 11/30/93	Describes removal of cyanide compounds from an aqueous waste stream, as well as heavy metals and precious metal values, by raising the pH with carbon dioxide, up to about 8 to about 10, and preferably between 8.5 to 9.5, before processing the aqueous waste stream through a membrane separation system. See col. 3, line 55 through col. 4, line 11, regarding membrane rejectable cyanide compounds.
*5,292,439	Morita, et al, 03/08/94	Discloses a method for making ultrapure water in an ion exchange resin with a total organic carbon content of 3 ppb. See col. 7, line 24 through col. 8, line 14, for a description of the ultrapure water treatment train.
*5,338,456	Stivers 08/16/94	Describes pretreatment for an RO system which includes (1) acid addition, (2) degasification, and (3) base addition. First, pH is reduced "to about 4.4", and then, after vacuum degasification, the pH of the feedwater is raised "up to bout 6.5" before it is fed to the RO unit. Generally, see col. 5, line s12-43, and col. 6, lines 37-54, which also mentions that it was "conventional in the art" to locate the degasification area downstream of the RO unit, rather than upstream. The Stivers system also requires "antiscalant to prohibit crystal growth." See col. 3, lines 65-69.

*5,358,640	Zeiher, et al 10/25/94	Describes technique for controlling calcium sulfate scaling in reverse osmosis equipment by controlling the pH to between about 6 and 7 and adding scale inhibitor and/or iron dispersants to the feedwater. See col. 2, line 60 through col. 3, line 2.
*5,385,664	Oinuma, et al 01/31/95	Describes an ultrapure water production apparatus that includes the use of biological treatment, UF or MF, and demineralization, prior to RO, and post RO treatment including UV, mixed bed ion exchange, and UF. See Fig. 1B. TOC is reduced to 0.5 to 0.8 ppb. See col. 5, Example 1, and claim 7.
*5,476,591	Green 12/19/95	Describes recovery of metal values from an aqueous charge stream, by using a nanofiltration system. Downward adjustment of pH of less than about 3.5, to keep ions in solution, is utilized. See col. 4, lines 63 through col. 5, line 12. Also, anti-scalant use is preferred when the product contains substantial amounts of calcium ions. See col. 25, lines 16-67.
*5,529,689	Korin 06/26/96	Shows two stage water purifier. Not believed particularly relevant.

*5,571,419	Obata, et al 11/05/96	Describes production of low TOC ultrapure water. Feedwater is pretreated via addition of reducing agent, cation ion exchange resin, anion ion exchange resin, decarbonation tower, cation ion exchange resin, and anion ion exchange resin. Then, the water is processed in a reverse osmosis unit. That is followed by UV, demineralization, and UF. TOC achieved ranges from 0.5 to 1.0 ppb. See Fig. 2, Example 1,and Table 1.
*5,573,662	Abe, et al 11//12/96	Teaches removal of TOC in ultrapure RO systems using UV light.
*5,573,666	Korin 11/12/96	Shows two stage water purifier. Not believed particularly relevant.
*5,645,727	Bhave, et al 07/08/97	Shows use of ceramic membranes to treat ultrapure water containing particle contaminants.
*5,670,053	Collentro, et al 09/27/97	Describes a process of remov9ing cations, anions, and carbon dioxide from feedwater to produce high purity water having a resistivity greater than 1 meg-ohm-cm. This disclosure teaches operation of the RO in the pH range of 5 to 8, and typically 5.5 to 7.5. Permeate from the first RO unit is introduced into a gas-liquid separation module which includes a gas operation membrane through which carbon dioxide passes. See Fig. 1, claim 1, and the Abstract.

*5,695,643	Brandt, et al 12/09/97	Discloses treatment of oil field brines by combination of membrane and thermal treatment. See col. 5, lines 1-53 regarding pretreatment to the RO system, which includes filtering and softening.
*5,766,479	Collentro et al 06/16/98	Describes process for producing pure water with resistivity of from 2 to 10 meg-ohm-cm, for pharmaceutical uses. Feedwater pH is adjusted to a basic solution, and the basic solution is feed to a first RO. Then, the permeate pH is adjusted to an acidic solution, which is fed to a second RO. In each case, ionization occurs of weakly ionized material, to enhance rejection at the respective pH of operation. See Fig. 1, and the abstract. Collentro's process does not teach or suggest the positive removal of alkalinity prior to initiating membrane separation. Also, the process requires two pass reverse osmosis operation, with inter-pass pH adjustment; this differential pH operation compromises the ability to return liquid to the first RO unit.
*5,925,255	Mukhopadhyay 07/1999	Parent case to this application.
6,267,891B1	Tonelli, et al 07/2001	Not prior art based on dates. Shows later developments in the art with respect to using weak acid cation exchange for dealkalization in a double pass RO system.

FOREIGN PATENTS

Patent Disclosure (Disclosure Date)	Country	Explanation
DE-1792304-A2 (03/1972)	Germany	Deals with phosphate removal. (see "OTHER DOCUMENTS" for English language Abstract).
JP-50-75987-A2 (06/1975)	Japan	Shows 2-pass RO system. (see "OTHER DOCUMENTS" for English language Abstract).
DE-2607737-A2 (09/1976)	Germany	Shows 2-pass RO system. (see "OTHER DOCUMENTS" for English language Abstract).
JP-55-012284-B1 (04/1980)	Japan ++	(++ - Disclosed as JP-50-088017-A2, KOKAI, in previous related U.S. case, now U.S. 5,925,225).
JP-59-112890-A2 (06/1984)	Japan	Discloses addition of alkali to RO feedwater stream, to adjust pH to 8 or higher, and preferably over 9, prevent precipitation of silica on membrane surfaces. (English translation provided)
JP-62-204892-A2 (09/1987)	Japan	Discloses lowering pH of feedwater by hydrogen form cation exchanger to prevent bacteria propagation, followed by reverse osmosis treatment. (English translation provided)
JP-62-294484-A2 (12/1987)	Japan	Removes silica in reverse osmosis equipment. (English translation provided)
JP-02-207888-A2 (08/1990)	Japan	Discloses method for produced ultra-pure water by enhancing TOC removal by pH adjustment downward. (English translation provided)

JP-02-227185-A2 09/1990)	Japan	Discloses method for treating water containing silica, by dealkalinating and softened by treating it in a weakly-acidic cation exchange resin, and subsequently raising the pH to make the RO feedwater neutral or slightly alkaline. (English translation provided)
JP-05-12040-B2 (02/1993)	Japan	(English translation of Patent not available to undersigned - see "OTHER DOCUMENTS" for English language of INPADOC Abstract Record)
JP-05-269463-A2 (10/1993)	Japan	(English translation of Patent not available to undersigned - see "OTHER DOCUMENTS" for English language JPO Abstract)
JP-06-049191-B2 (06/1994)	Japan	Teaches reduction of carbonates to reduce calcium carbonate scaling in an RO system. (English translation provided)
JP-08-029315-B2 (03/1996)	Japan	Combines two step RO system with membrane degasification (English translation provided)
DE-19603494-C2 (02/1998)	Germany +	Shows use of a cation exchanger prior to RO. (English translation provided) (+ = A2 document (not obtained) published 08/1997, per face sheet of C2 document)

OTHER DOCUMENTS

RELATING TO: Patent No.	Country	Date/	Explanation (ALL DOCUMENTS IN ENGLISH LANGUAGE)
JP-50-75987-A2	Japan	(06/1975)	Derwent Abstract of KOKAI
DE-1792304-B	Germany	(08/1975)	Derwent Abstract to issued patent
DE-2607737-A1	Germany	(09/1976)	Derwent Abstract to unexamined patent application
JP-53-004777-A2	Japan	(01/1978)	Kokai Abstract (Patolis) Shows 2-pass RO system
JP-54-069579-A2	Japan	(06/1979)	Kokai Abstract (Patolis)
JP-54-083688-A2	Japan	(07/1979)	Kokai Abstract (Patolis) Shows 2-pass RO system
JP-56-139106-A2	Japan	(10/1981)	Kokai Abstract (Patolis) Describes pH dependency of certain in RO rejection, including boric acid
JP-58-118538-A2	Japan	(07/1983)	Dialog Abstract of Kokai Describes 2-pass RO system with addition of alkali between the first and second RO units
JP-58-122084-A2	Japan	(07/1983)	Kokai Abstract (Patolis) Describes 2-pass RO system for seawater desalting
JP-59-112890-A2	Japan	(06/1984)	Patent Abstracts of Japan Vol. 008, No. 232 (C-248) 25 October 1984
JP-59-112890-A2	Japan	(06/1984)	Abstract - Figures - Tables Derwent Publications Ltd., London, GB AN 1984-198089 XP002147898
JP-59-112890-A2	Japan	(06/1984)	Chemical Abstracts Vol. 101, No. 22 26 November 1984 (1984-11-26) Columbus, Ohio, US Abstract No. 197574 XP002147895
JP-62-110795-A2	Japan	(06/1987)	Patent Abstracts of Japan Published: 21 May 1987
JP-62-110795-A2	Japan	(05/1987)	Delphion Abstract Publication Date: 21 May 1987

JP-62-294484-A2	Japan	(12/1987)	Patent Abstracts of Japan Vol. 012, No. 191 (C-501), 3 June 1988
JP-62-294484-A2	Japan	(12/1987)	Patent Abstracts of Japan (Application No. 61138486)
JP-62-294484- A2	Japan	(12/1987)	Delphion Abstract; Publication Date: 21 December 1987
JP-62-294484-A2	Japan	(12/1987)	Abstract - Tables Derwent Publications Ltd., London GB AN 1988-033867 XP002147896
JP-62-294484-A2	Japan	(12/1987)	Chemical Abstracts Vol. 108, No. 20 16 May 1988 (1988-05-16) Columbus, Ohio, U.S. Abstract No. 173328 XP002147894
JP-63-028486-A2	Japan	(02/1988)	Application No. 6117235 Patent Abstracts of Japan Published: 06 February 1988
JP-63-028486-A2	Japan	(02/1988)	Delphion Abstract Publication Date: 06 February 1988
JP-02-052088-A2	Japan	(02/1990)	Patent Abstracts of Japan Publication Date: 21 February 1990 (Full patent English translation provided above)
JP-02-052088-A2	Japan	(02/1990)	Patent Abstracts of Japan
JP-02-052088-A2	Japan	(02/1990)	Patent Abstracts of Japan Delphion Abstract Publication Date: 21 February 1990 Full patent English Translation provided above.
JP-02-227185-A2	Japan	(09/1990)	Patent Abstracts of Japan
JP-02-227185-A2	Japan	(09/1990)	DialogIP Document Abstract
JP-02-227185-A2	Japan	(09/1990)	Delphion Abstract; Publication Date: 10 September 1990
JP-02-227185-A2	Japan	(09/1990)	Issued 10 September 1990 - Derwent Abstract
JP-04-118004-A2	Japan	(04/1992)	Patent Abstracts of Japan 20 April 1992 Application No.: 02235899

JP-05-012040- B2	Japan	(02/1993)	Issued: 17 February 1993 (INPADOC Abstract Record)
JP-05-269463-A2	Japan	(10/1993)	Patent Abstracts of Japan Vol. 018, No. 043 (C-1156) 24 January 1994
JP-05-269463-A2	Japan	(10/1993)	Abstract Derwent Publications Ltd., London GB AN 1993-364476 XP002147897

Authors; Title	Date/ Volume Pages	Explanation
*Milstead, C.E., et al Rejection of Carbon Dioxide and pH Effects in Reverse Osmosis Desalination Desalination	1971 pp. 217-223	Generally describes behavior of carbon dioxide in RO units See p. 222, 1st paragraph under "Discussion".
*Crabbe, Daniel C.M. A Double Pass Reverse Osmosis System	September 1976	Describes use of 2 pass RO. Indicates higher carbonate rejection at pH in excess of 7.5.
*Crabbe, Daniel C.M. A Double Pass Reverse Osmosis System Industrial Water Engineering.	December 76 January 77	Describes a 2-pass RO system. See p. 14 regarding rejection of carbonate at pH greater than 7.5.
*Peterson, R.J., et al Development of the FT-30 Thin-Film Composite Membrane For Desalting Applications	July 6-10, 1980	See p. 11; indicates operation up to pH 11 o.k.

*Larson, R.E. et al Development of the FT-30 Thin-Film Composite Membrane National Water Supply Improvement Association 9th Annual Conference and International Trade Fair	May 31-June 4, 1981	Describes use of FilmTec FT-30 membranes in various applications. See various flux projections; see p. 20 regarding operation at high pH in plating solutions.
*Nakamura, Tadashi Seawater Desalination by Reverse Osmosis Process	July /August 1981	Describes use of RO for seawater desalination. Note scaling problems described 2nd col., p. 39.
*Larson, R.E. The FT-30 Seawater Reverse Osmosis Membrane - Element Test Results Desalination 38	1981 p. 473-483	See Figs. 5 and 6. Note long term flux below 20 gfd.
*Ed. Walter Lorch Handbook of Water Purification London MacGraw-Hill Cop.	1981 XVIII, 715 p. III	Describes customary RO pretreatment with acid to keep pH low, with later carbon dioxide removal.
*Development of FT-30 Membranes In Spiral Wound Modules	October 1982	General information on FT membranes. See Fig. 5 and note Fig. 14, regarding flux decline over time.
*E.I. du Pont de Nemours & Co. Permasep Products Engineering Manual	1982	General membrane information. See borate rejection curve Fig. 5 for B-9 permeators, in Bulletin 305, page 6. See Fig. 2, Bulletin 502, p. 3, regarding bicarbonate passage. See Fig. 11, Bulletin 502, page 15, regarding silica solubility.

*1982 Report on Technological Development For Boiler Water by Reverse Osmosis, Exhibit Ko No. 1, Fresh Water Generation Promotion Center	March, 1983 pp. 1-11, 45-97	Describes various testing on RO membranes. Note relationship of bacteria population to pH of water.
*Lee, Eric K.L. Novel Composite Membranes	April 1983	Describes development of composite membranes. Not believed particularly relevant.
*Handbook of Membrane Technology	July 15, 1983 p. 26-28	Shows relationship of carbon dioxide to pH of feedwater. (No English abstract. In Japanese language, no English translation).
*Annual Research Report No. 42, Shikoku Electric Power Co., Ltd.	September 1983	Shows use of typical 2B3T system prior to RO. Multiple pass operation indicated. (In Japanese language. No English translation available).
*Cadotte, J. Evolution of Composite Reverse Osmosis Membranes	1984	Describes FT-30 membranes. Note p. 290 where pH of 3-11 is recommended.
*Zosui Gijutsu Water Producing Technology	1984 Vol. 10, No. 2, pp. 13-22	Shows double pass RO with initial feed at low pH (English language abstract only. In Japanese language. No translation available).
*Handbook of Membrane Technology	July 15, 1985 pp. 184-198	Shows use of RO in production of municipal water. (In Japanese language. No English translation available).
*Edited by Bipin S. Parekh Applications for High-Purity-Water Production	1988	General background information. See p. 63-65 regarding rejection and flux definitions.

*Petersen, R.J., et al Industrial Applications of the FT-30 Reverse Osmosis Membrane World Filtration Congress III (1989) pp. 541-547	1989 pp. 541-547	General information on FT-30 membranes. See p. 543 on sodium borate rejection.
*Dyke, F.T., et al Removal of Salt, Oil and Boron From Oil Field Wastewater by High pH Reverse Osmosis Processing	September, 1992	Describes in more detail the process set forth in the Tao patent, U.S. 5,250,185. Reveals that in spite of using a "high rejection" version of a FilmTec Sea Water membrane, Si02rejection in Tao's process was only 39%. In the present invention, Si02 removal was 99.87%. So, this paper shows that the Si02 passage in the Tao process was 61%. This is in marked contrast to the much less than 1% Si02 passage (actually, 0.13% Si02 passage) achieved in the instant invention, in spite of the use of a FilmTec brackish water membrane that has "minimum salt rejection" 2.5 times worse than the seawater type RO membrane used by Tao. Also, with respect to TOC, an important parameter in ultrapure water, passage was 0.80% in the Tao process, while in the instant invention it was 0.34%. So, Tao's TOC rejection was worse, even when using a better membrane, by about 5.9 times, on a performance equalized basis. See Table 2 of this paper, and compare to Table 4 in the pending application. Note membrane performance decay shown in Fig. 7 of this paper, and compare to Figs. 5, 6, 7, and 8 of the present application.

*FT30 Membrane Description Technical Bulletin	December 1992	Indicates that continuous operation from pH 3 to 11 is possible.
*Tao, F.T. et al Conversion of Oilfield Produced Water Into an Irrigation/Drinking Quality Water	March, 1993	Describes removal of boron and water soluble organics from oilfield produced water via hardness removal followed by reverse osmosis at a pH of 10.6 - 11.0. Note membrane performance decay shown in FIG. 4; compare to FIGS. 5, 6, 7, 8 of this application.
*Aronovitch, H. et al Weakly Acidic Cation Performance Treating Water Containing High Iron	May/June 1995	Describes the efficient performance of a weakly acidic cation resin in removing hardness associated with alkalinity.
*Auerswald, D. Optimizing the Performance of Reverse Osmosis/Continuous Electrodeionization System	May/June 1996	Describes methods of operation used to minimize cleaning of conventional RO systems.
*Description of the FT-30 Membrane	undated	Same as reference above. Indicates operation possible up to pH 11.
*Reverse Osmosis Element Warranty Filmtec Corporation	undated	Not believed particularly relevant.
*Parks, C.S. et al Fundamentals of Ion Exchange In Water Treatment Presented at the 7th Annual Liberty Bell Corrosion Conference	undated	Describes fundamentals of ion exchange in water treatment.
Filmtec Membranes, Membrane System Design Guidelines (Dow)	published March 1996	Shows permeate flow rates and membrane areas for GFD flux.

Practical Ion Exchange Akimitsu Miyahara, et al; published by Kagaku Kogyo Ltd. (pages 99-102)	January 1, 1972	Describes use of decarboxylation tower and weak acid cation exchange resin (provided in related Japanese Patent Application by communication from the examiner dated July 31, 2001.

7. Translation of Non-English Language Documents

JAPANESE:

Japanese Patent Nos. JP-55-012284-B1 JP59-112890-A2, JP-62-204892-A2, JP-62-294484-A2, JP-02-207888-A2, JP-02-227185-A2, JP-06-049191-B2, and JP-08-029315-B2 are translated into the English language. Copies of the written English translations are attached.

Japanese Patent Nos. JP-50-75987-A2, JP-05-012040-B2, and JP-05-269463-A2 are not in the English language. Written English language translations are not within the possession, custody or control of any individual designated in Section 1.56(c).

English translations of Japanese Patent Nos. JP-59-112890-A2, JP-62-204892-A2, JP-02-207888-A2 and JP-02-227185-A2 were previously provided to the Patent Office, however the Japanese language original patent documents were not available at that time. Japanese language documents are now available for Japanese Patent Nos. JP-59-112890-A2, JP-02-207888-A2 and JP-02-227185-A2 and are being provided.

The publication entitled "Practical Ion Exchange" dated January 1, 1972 is translated into the English language. A copy of the written English translation is attached.

GERMAN:

German Patent No. DE-19603494-C2 is translated into the English language.

German Patent Nos. DE-1792304-A2 and DE-2607737-A2 are not translated into the English language. Written English language translations are not within the possession, custody or control of any individual designated in Section 1.56(c).

8. Identification of Person(s) Making This INFORMATION DISCLOSURE STATEMENT

The person making this statement is the attorney who signs below on the basis of the information supplied by the inventor and information in possession of the attorney, both of which have been reviewed by the attorney.

Respectfully submitted,

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